

We Claim:

1. A coating composition comprising an aqueous mixture comprising acid-stable particles and one or more fluoroacids, wherein the amount of the acid-stable particles in the coating composition is from 0.005% to 8% by weight on a dry weight basis.
2. The coating composition of claim 1 wherein the acid-stable particles are aluminum-modified silica particles, and the amount of the acid-stable particles in the coating composition is from 0.005% to 5% by weight on a dry weight basis.
3. The coating composition of claim 1 wherein the acid-stable particles are nonaluminum-modified silica particles, and the amount of the acid-stable particles in the coating composition is from 0.005% to 5% by weight on a dry weight basis.
4. The coating composition of claim 1 wherein the acid-stable particles are polymeric organic particles.
5. The coating composition of claim 1 wherein the mixture further comprises a product of the acid-stable particles and the one or more fluoroacids.
6. The coating composition of claim 2 wherein the aluminum-modified particles comprise about 0.006% to about 1% by weight on a dry weight basis of the composition.
7. The coating composition of claim 2 wherein the aluminum-modified silica particles have a $\text{SiO}_2\text{:Al}_2\text{O}_3$ weight ratio from 80:1 to 240:1.
8. The coating composition of claim 2 wherein the aluminum-modified silica particles have a $\text{SiO}_2\text{:Al}_2\text{O}_3$ weight ratio from 120:1 to 220:1.

9. The coating composition of claim 3 wherein the nonaluminum-modified particles comprise about 0.006% to about 1% by weight on a dry weight basis of the composition.

10. The coating composition of claim 1 wherein the acid-stable particles maintain a change in viscosity of ten seconds or less.

11. The coating composition of claim 1 wherein the composition has a pH from 3 to 6.

12. The coating composition of claim 1 wherein the composition has a pH from 3.5 to 5.

13. The coating composition of claim 1 wherein the acid-stable particles maintain a change in viscosity of three seconds or less.

14. The coating composition of claim 1 wherein the amount of the acid-stable particles in the coating composition is from 0.006% to 2% by weight on a dry weight basis.

15. The coating composition of claim 1 wherein the amount of the acid-stable particles in the coating composition is from 0.007% to 0.5% by weight on a dry weight basis.

16. The coating composition of claim 1 wherein the concentration of the one or more fluoroacids in the coating compositions is from about 5 ppm to about 1000 ppm.

17. The coating composition of claim 1 wherein the acid-stable particles maintain a change in viscosity of one second or less.

18. A coating on a metal substrate comprising acid-stable particles attached to the metal substrate through a metal-oxide matrix, wherein the coating coverage of the metal substrate is from 5 mg/sq ft to 50 mg/sq ft.

19. The coating of claim 18 wherein the metal-oxide matrix comprises one or more metals selected from the group consisting of titanium, zirconium and silicon.

20. The coating of claim 18 wherein the acid-stable particles are selected from one or more of the group consisting of aluminum-modified particles, nonaluminum-modified particles, and organic polymeric particles.

21. The coating of claim 18 wherein the coating coverage of the metal substrate is from 8 mg/sq ft to 30 mg/sq ft.

22. The coating of claim 18 wherein the acid-stable particles are present at a concentration from 5 mg/sq ft to 25 mg/sq ft.

23. The coating of claim 18 wherein the metal in the coating is present at a concentration from 0.5 mg/sq ft to 6 mg/sq ft.

24. The coating of claim 18 wherein the acid-stable particles are present at a concentration from 10 mg/sq ft to 20 mg/sq ft.

25. The coating of claim 18 having a thickness that is within 75% to 125% of the average particle diameter of the acid-stable particles.

26. A coating composition prepared by a process comprising:
providing acid-stable particles and one or more fluoroacids; and

mixing the acid-stable particles and the one or more fluoroacids in water, wherein the coating composition has a pH from 2 to 7, and the amount of the acid-stable particles in the coating composition is from 0.005 to 8% by weight on a dry weight basis.

27. The coating composition of claim 26 wherein the acid-stable particles are selected from one or more of the group consisting of aluminum-modified particles, nonaluminum-modified particles, and organic polymeric particles.

28. The coating composition of claim 27 wherein the aluminum-modified particles comprise about 0.006 to about 1% by weight on a dry weight basis of the composition.

29. The coating composition of claim 27 wherein the nonaluminum-modified acid stable particles comprise about 0.006% to about 1% by weight on a dry weight basis of the composition.

30. The coating composition of claim 27 wherein the organic particles comprise about 0.01% to about 5% on a dry weight basis by weight of the composition.

31. The coating composition of claim 26 wherein the composition has a pH from 3 to 6.

32. The coating composition of claim 26 wherein the composition has a pH from 3.5 to 5.

33. The coating composition of claim 26 wherein the amount of the acid-stable particles in the coating composition is from about 0.006% to about 2% by weight on a dry weight basis.

34. The coating composition of claim 26 wherein the amount of the one or more fluoroacids in the coating compositions is from about 5 ppm to about 1000 ppm.

35. The coating composition of claim 26 wherein the acid-stable particles maintain a change in viscosity of three seconds or less.

36. A coating composition consisting essentially of 0.006% to 2% by weight, on a dry weight basis, of acid-stable particles and one or more fluoroacids having a pH from about 3 to 6, wherein the coating composition in a cured state provides a coating coverage on a metal substrate from 8 mg/sq ft to 30 mg/sq ft.

37. The coating composition of claim 36 wherein the acid-stable particles are selected from the group consisting of aluminum-modified particles, nonaluminum-modified acid stable particles, and organic polymeric particles.

38. The coating composition of claim 36 wherein the amount of the acid-stable particles in the coating composition is from about 0.007% to about 0.5% by weight on a dry weight basis.

39. The coating composition of claim 36 wherein the amount of the one or more fluoroacids in the coating compositions is from about 5 ppm to about 1000 ppm.

40. The coating composition of claim 36 wherein the acid-stable particles maintain a change in viscosity of three seconds or less.